

REVIEW
of the opponent of the habilitation thesis of
Ing. Peter Sedláček, PhD,
employee of the Department of Informatics FRI UNIZA

1. The Relevance of the Presented Topic

The title of the presented habilitation thesis is: “Reliability analysis of non-coherent systems”. Reliability, as a crucial characteristic of technical systems, is highly relevant nowadays, as system failures can have unexpected and often fatal consequences. Although non-coherent systems constitute a minority in terms of reliability, their analysis is scientifically and technologically important because it enables the investigation of systems involving the human factor. Based on the preceding analysis, the focus of this thesis can be considered both timely and relevant within the current research landscape.

2. Evaluation of the Formal and Substantive Aspects of the Habilitation Thesis

The presented habilitation thesis consists of the following seven publications. These contributions represent a summary of the author’s research in the discussed field of reliability analysis of non-coherent systems. The proposed publications describe certain steps in the reliability analysis of non-coherent systems and include both two-state and multi-state systems:

- 1) Peter Sedlacek, Elena Zaitseva, Vitaly Levashenko, and Miroslav Kvassay. Critical state of non-coherent multi-state system. *Reliability Engineering & System Safety*, 215:107824, November 2021.
- 2) Peter Sedlacek, Patrik Rusnak, and Sergey Stankevich. Critical state analysis of drone fleet in limited space. In *2022 IEEE 16th International Scientific Conference on Informatics (Informatics)*, page 262–266. IEEE, November 2022.
- 3) Elena Zaitseva, Vitaly Levashenko, Peter Sedlacek, Miroslav Kvassay, and Jan Rabcan. Logical differential calculus for calculation of Birnbaum importance of non-coherent system. *Reliability Engineering & System Safety*, 215:107829, November 2021.
- 4) Elena Zaitseva, Peter Sedlacek, and Vitaly Levashenko. Importance analysis of non-coherent multi-state system. *Reliability Engineering & System Safety*, 266:111618, February 2026.
- 5) Peter Sedlacek and Elena Zaitseva. Software reliability model based on syntax tree. In *2021 International Conference on Information and Digital Technologies (IDT)*, pages 73–82. IEEE, June 2021.
- 6) Peter Sedlacek, Patrik Rusnak, and Terezia Vrabkova. *Software Tests Quality Evaluation Using Code Mutants*, pages 39–48. Springer Nature Switzerland, 2023.
- 7) Peter Sedlacek and Patrik Rusnak. Architecture design of software solution for reliability analysis. In *2024 IEEE 17th International Scientific Conference on Informatics (Informatics)*, page 321–325. IEEE, November 2024.

The first publication contains a formal definition of integrated partial logic derivatives for non-coherent multi-state systems. These derivations are based on those defined for coherent systems and generalize them to non-coherent systems, while also incorporating specific features of such systems that are not required for coherent

systems. The application of these logical derivatives for calculating critical states of systems is demonstrated in this publication, as well as in publication No. 2.

The next publication, i.e., publication No. 3, is devoted to the calculation of Birnbaum's importance measure of non-coherent two-state systems using a matrix-based approach. Publication No. 4 formalizes the structure and Birnbaum's measure for non-coherent multi-state systems. These measures were defined with respect to the integrated partial logic derivatives defined in publication No. 1. The next two publications focus on software reliability, with publication 5 defining a deterministic model for evaluating software reliability. Publication 6 describes the evaluation of software tests using mutation testing. The last publication is devoted to the conceptual design of a software solution for reliability analysis.

In terms of content, the work can be divided into two groups. The first group (publications 1, 3, and 4) includes the formalization and definition of methods for analyzing the reliability of non-coherent systems. Among these, publication No. 3 focuses on two-state systems, while publications 1 and 4 emphasize multi-state systems. Publications 2, 5, 6, and 7 are more application-oriented, where these methods are applied, methods are proposed for specific types of systems, or a particular tool is developed. I assume the author arranged the publications this way so that the first two present qualitative analysis, the next two focus on quantitative analysis, and the subsequent ones pertain to software; however, personally, I would prefer an arrangement that progresses from two-state systems to multi-state systems and from theoretical to applied works. Overall, the work is of a high standard in both content and form, demonstrating the author's active engagement with the field.

3. Questions and Comments

- 1) In publication number 4, you formalized the structure and Birnbaum's measure for non-coherent multi-state systems. Is it possible to formalize other importance measures in a similar way, such as the Critical measure or Fussel-Veselly?
- 2) In publication number 7, you describe a proposed architecture for a software solution for reliability analysis. Can you describe the current state of this solution? Has it remained only a theoretical description, or is active work and development underway?
- 3) Which future work is foreseen? Which future development will the architecture design of a software solution for reliability analysis obtain (refer to paper 7)?

4. Evaluation of Habilitation Requirements Based on the Habilitation Dossier

The habilitation materials allow one to conclude not only about the candidate's scientific and research work but also their pedagogical and teaching work.

I have known him since the scientific conferences IEEE IDT 2019 in Žilina and RECI 2022 in Delft, and have communicated with him. The candidate is actively engaged in teaching, covering a range of areas. From the communication with the candidate as well as with their colleagues and supervisors, I know him as an engaged researcher; he strongly implements his research projects and contributions in the curricula of the Faculty of Management Science and Informatics as well as within the educational and pedagogical process at the University of Žilina.

The candidate is actively involved in research, as evidenced by the contributions in which he participates, as well as his publication output. In addition, the candidate strongly engages in other useful scientific and fellow activities, such as serving on organizing committees.

Based on the criteria established for the Faculty of Management and Informatics at the University of Žilina in Žilina, I can state that the candidate has met all the required criteria.

Summary

Based on the presented information, I recommend the author for the scientific and pedagogical title of associate professor.

On 26.03.2026

Reviewer

Head of the Chair for IT / Studienleiter Informationstechnik

Prof. Dr. habil. Andriy Luntovskyy

**DUALE HOCHSCHULE SACHSEN
Staatliche Studienakademie Dresden**

Hans-Grundig-Straße 25
01307 Dresden

Telefon: +49 351 44722 521

andriy.luntovskyy@dhsn.de

<https://www.dhsn.de/dresden>

<https://sites.google.com/site/luntovskyy/home-page>